Space Weather Forecast

Issued on Tuesday 31 December 2024 at 13:15 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Minor/Moderate radio blackouts (R1/R2) expected with a slight chance of Strong (R3) blackouts. A coronal mass ejection (CME) arrival is expected on 31 Dec, with G1-G2 Minor/Moderate storm likely, with a slight chance of G3 Strong storm.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: High levels with six Moderate-class flares in the last 24 hours, the peak flare originating from the most magnetically complex region on the disc, located in the northwest. This region has produced the majority of the Moderate-class flares with an active region in the southeast also contributing.

There are currently ten sunspot regions on the visible disc. The region in the northwest that produced the peak flare is the largest and most active region but has been relatively stable in terms of growth over the last 24 hours. Further complex groups lie in the southeast and the central northern hemisphere. The remaining regions are all relatively simple or only slowly evolving.

A filament eruption (arc of plasma) was observed in imagery within the vicinity of a sunspot region located in the southeast quadrant. This produced a partial halo coronal mass ejections (CMEs), which has been analysed as potentially being Earth-directed, with an expected arrival at Earth on Day 1 (31 Dec).

Another partial halo CME emerged shortly after 29/1800UTC, again from the southeast and is likely to have an Earth-directed element arriving on Day 2 (01 Jan). Although it appears to be rather faint compared to the previous event, with less material expected.

Solar Wind / Geomagnetic Activity: Solar winds showed a slow regime. The total magnetic field strength has been weak to moderate. The north-south component of the magnetic field has also varied generally weakly. Geomagnetic activity was Quiet throughout (Kp 0-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 remained at background levels throughout, well below the 1-pfu S1/Minor Radiation Storm threshold.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

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Four-Day Space Weather Forecast Summary

Solar Activity: Generally Moderate solar activity is expected with frequent Moderate-class flares forecast through the period, with a chance of isolated Strong-class flares, especially from AR3936 in the northwest.

Solar Wind / Geomagnetic Activity: No coronal hole fast winds currently feature in the forecast. A partial halo CME observed in imagery looks to be associated with an Moderate-class flare and a filament eruption near the vicinity of a sunspot region located in the southeast quadrant of the disc at around 29/0440UTC. This event has been analysed as Earth-directed, which is expected to arrive at Earth on Day 1 (31 Dec). A second, slower partial halo CME was observed from a sunspot region in the southeast later on 29 Dec, with the potential to reach Earth on Day 2 (01 Jan), however little material is expected with this second CME.

Geomagnetic activity is expected to increase from Quiet due to the aforementioned Earth-directed CMEs arriving on Days 1-2 (31 Dec - 01 Jan) and are likely to enhance geomagnetic activity, reaching G1-G2 Minor/Moderate storm, with a slight chance of G3/Strong storm. Any CME effects gradually waning on Day 3 (02 Jan), back towards Quiet to Unsettled conditions.

Energetic Particles / Solar Radiation: There is a slight chance of S1/Minor Radiation Storm enhancements during the period, should any significant flares occur from the larger regions on the disc as they rotate into the western hemisphere.

Geomagnetic Storms

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	No	60	60	20	5
Strong	**G3**	No	20	20	5	1
Severe	**G4**	No	1	1	1	1
Extreme	**G5**	No	1	1	1	1

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Radio Blackouts - X-Ray Flares

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	80	80	60	60
Very Active	R3-R5 (X Class)	No	20	20	10	10

Solar Radiation Storms (High Energy Protons)

Radiation Storms	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	20	20	20	20
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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